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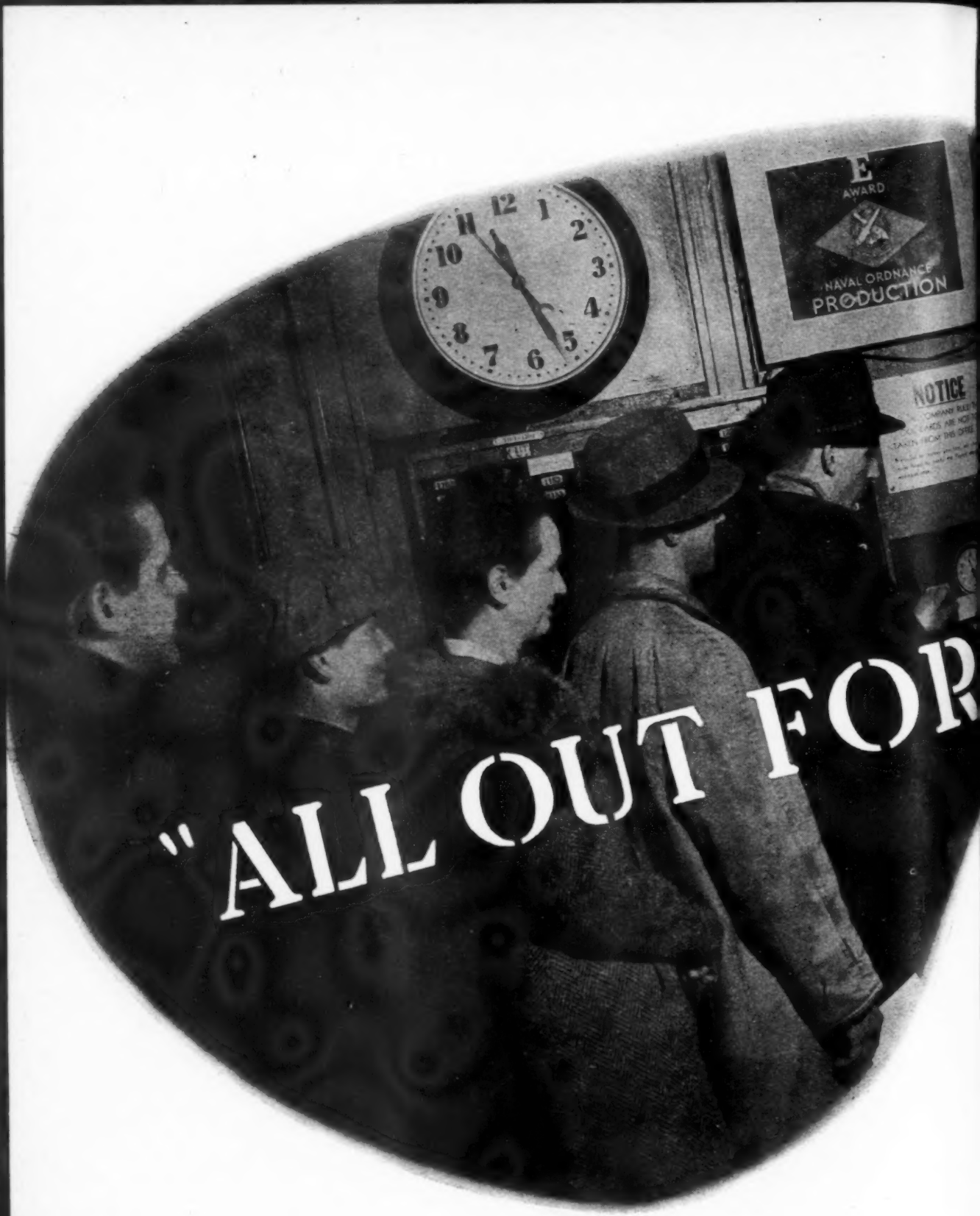
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A STUDY OF READING ABILITY AS RELATED WITH PHYSICAL, MENTAL AND PERSONALITY TRAITS IN SENIOR HIGH SCHOOL STUDENTS*

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Principal

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Los Angeles, California

Purpose: The purpose of this study is to determine:

1. The average *increase* in reading grade placement of those *trained* with the metronoscope compared to those *not* trained with the metronoscope.
2. The relation between the above two groups as shown by ophthalmograph results.
3. The correlation between "eye-status" and increase in reading grade placement.
4. The correlation reading grade placement at beginning of the semester and number of schools attended to the 6th grade.
5. The correlations between scores on the California Test of Personality and the reading grade placement at beginning of semester.
6. The relation of reading grade placement and deviation from normal weight and height.

Method: The approach to a problem of this kind is an extremely important factor. In order to obtain expert advice on the proposed investigation, Dr. Alfred S. Lewerenz, assistant supervisor in the Educational Research and Guidance, Curriculum Section, Los Angeles City Schools, was consulted. Dr. Lewerenz gave invaluable aid and encouragement. A conference was also held with all of those who were in any way connected with the experiment. Those in this group were Dr. Lewerenz and Dr. Peters, in charge of the eye-sight survey, the teachers:

*Submitted on July 6, 1942 for publication in the October issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

Miss Armstrong, Mrs. Heath, Miss Mayock, and Miss Magee, chairman of the English Department, and a representative of the American Optical Company.

Dr. Peters conducted the eyesight survey including the making of ophthalmograph records of eye-movements while reading. The eye-movement photographs were taken before and after the training period of about four months. The eyesight survey involved the collection of the following data:

1. History, including glasses worn or not, blurred vision, headaches, etc.
2. Visual acuity.
3. Retinoscope (static).
4. Muscle balance at *distance* as to hyperphoria, esophoria or exophoria; also, at *near*, with Maddox Wing Test.
5. Near point fusion test.

In order to classify the students with regard to their visual efficiency, an arbitrary grouping was made as follows:

Group 1. Best vision (all those not in Groups 2 or 3).

Group 2. Those having any combination of *two* of the following A-B-C-D:

A. Vision. 20/40 or less in either eye, with or without glasses.

B. Retinoscope. Medium defect in either or both eyes (plus or minus .75 D to 1.50 D).

C. Muscle imbalance. Hyperphoria, Esophoria, or Exophoria *at distance.*

D. Fusion at near. Fail.

Group 3. Combination of A or B and C or D of the following:

A. Vision. 20/50 or less in either eye, with or without glasses.

B. Retinoscope. High defect in either or both eyes (plus or minus 1.50 D. or above).

C. Muscle imbalance. Same as in Group 2.

D. Fusion at near. Same as in Group 2.

The statistical work in this study was done by the Research and

Statistical division of the Los Angeles City Schools through the courtesy of Dr. Herbert Popenoe.

The classroom instruction was done by three teachers mentioned above with Miss Armstrong handling three classes, Miss Mayock, two classes and Mrs. Heath, one class. These classes were made up of B10 grade boys and girls whose record on a standardized reading test (Progressive Achievement Tests—Advanced Battery) showed them one or more years retarded. Miss Armstrong used the metronoscope with two classes while Miss Mayock used the metronoscope with one class only. Mrs. Heath did not use the metronoscope. This arrangement allowed three control classes.

The test of personal and social adjustment was made on the California Test of Personality—Secondary Series. This test was given in the classes by the teacher of the class.

The work covered in this experiment was done during the fall semester of 1939.

Results	With Metronoscope Training	Without Metronoscope Training
1. Total number of cases studied: 100		
2. Average original Reading Grade Placement	7.5	7.8
3. Average increase in Reading Grade Placement (months)	15.2	12.7
4. Average increase in words per minute as measured by the ophthalmograph	68.	69.8
5. Average increase in comprehension (per cent)	23.	21.
6. Average decrease in number of fixations	14.2	16.6
7. Average decrease in number of regressions	7.4	9.0
8. Average I. Q.	91.	92.
9. Average Eye Status	1.77	1.56
10. Average Scores on Personality Tests:		
Self Adjustment	48.2	42.0
Social Adjustment	52.0	51.0
Total Adjustment	50.0	46.0

The following correlations were obtained:

1. Increase in reading grade placement as shown by the standardized reading test *and* increase in words per minute read, as shown by ophthalmograph ..... .01

2. Original reading grade placement and eye-status grouped as given above ..... .08
3. Number of schools attended to 6th grade and original reading grade placement ..... .15
4. Personality tests and original reading grade placements:
   - Self Adjustment ..... .35
   - Social Adjustment ..... .45
   - Total Adjustment ..... .55

Discussion of Results

Barr, Burton and Brueckner,* in their volume on Supervision have said, "At its best scientific supervision means securing as complete and accurate a picture as possible of current school practices. . . . Knowledge about learning materials and methods of learning is utilized to improve conditions."

It is with this hope for as "accurate a picture as possible" that this study is undertaken. Much has been written on the subject of reading in all of its phases and many contradictory statements have been made. Some such assertions have been postulated with reference to the matter of eyesight and reading ability. Probably one of the most considerate statements in this field is that of Dr. Albert J. Harris in his book, How to Increase Reading Ability, in which he said, "An examination of the research in this field (reading ability and poor vision) discloses the interesting fact that studies at the high school or college level tend to find little difference between the vision of good and poor readers, while studies of elementary school pupils generally find significantly higher proportions of poor readers with visual defects. A plausible reason for this discrepancy may be that extremely poor readers tend to drop out of school before they get very far above elementary school so that only those with poor vision who have been able to compensate for their difficulties are to be found in the higher level studies." The reader will note that the results shown in item number 2 above seem to verify this statement. A correlation value of .08 is negligible.

An increase in reading grade placement of 2.5 months for those using the metronoscope is a result which is fairly consistent with other results the writer has obtained before.[1] When the Critical Ratio formula

*A. S. Barr, W. H. Burton, and L. J. Brueckner, *Supervision* (New York: D. Appleton Century Company, 1938).

1. Goodsell, J. G. Some Reading Improvement Results in a Senior High School, Los Angeles School Journal, May 23, 1938.

is applied to this result we find, however, that it is not significant. It has been suggested that possibly the testing done in the use of the metronoscope would account for this result, but the teachers who used this instrument do not feel such is the case. Whether these results are due to motivation or "on some basis other than that of the control exerted by these exercises on eye movements as such,"[2] can only be decided by further research and study.

Inconsistent and inconclusive findings are evidenced in the results shown by the ophthalmograph when compared to those shown by the standardized tests. It is the writer's opinion that this instrument is of value largely in the study of individual cases when used over a period of time. These results reaffirm the Dartmouth report.[3]

Rather a startling result is shown in the low correlation (.15) between the number of elementary schools attended and the original reading grade placement upon arrival at the senior high school level. This is exactly opposed to current thought and probably shows that other factors (I.Q., etc.) are more important than the number of schools attended.

The correlation (.55) shown between scores on total adjustment (California Test of Personality) and original reading grade placement, although not as indicative as might be expected, yet it holds out promise of value in remedial work.

An attempt was also made to determine a relation between original reading grade placement and deviation from the normal weight and height but without success. Also, no effect upon the extrinsic eye muscles for those using the metronoscope could be found. Criticism of the use of this instrument, in this regard, is evidently without foundation.

After several years of study in this field, the writer is convinced that most of those students who are retarded in their reading ability will improve while in regular classes. It is only those whose reading grade placement is considerably (2 or more years) below their expectancy who seem to need special attention. "Most of us have been taken in by the false notion that speed of reading is a measure of intelligence. Some books should be read quickly, others slowly, even laboriously. Intelli-

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2. Anderson, J. H. Research in the Psychology of Reading. Journal of Exceptional Children, January, 1938.

3. Dartmouth College Publication 1938. An Evaluation of Visual Factors in Reading.

gence in reading is the ability to read different things differently according to their worth."[4]

It will also be noted that items number 3-6 and 7 under results corroborate the following statements of the Dartmouth study: "The frequency of regressive eye-movements as measured by the eye-movement camera is not necessarily a handicap to efficient reading" and "The provision of the extra reading program at Dartmouth College is to increase the speed of reading but it does not guarantee gain in comprehension in reading or improvement in college grades."

Eyesight specialists should particularly note correlation No. 2 which shows the *low relationship* between reading grade placement and eye-status. This is undoubtedly due, in part, to the phenomenon of compensation. In other words many students who have suffered eye defects for years have learned to "get-by" or they have compensated for these defects. Many high school students are very reticent about wearing spectacles no matter how urgent the case may be and especially so if the reason is not *very apparent* to the student.

The reading process is a complex procedure and for remedial work, individual study is required. Because of these facts this type of work is most interesting.

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4. Adler, Mortimer J. How to Mark a Book, Reader's Digest, August 1940.

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OCULAR PHOTOGRAPHY AS A SCIENTIFIC APPROACH TO THE STUDY OF OCULAR PATTERNS AND THEIR PSYCHOLOGICAL IMPLICATIONS*

Herman F. Brandt, Ph.D.
Drake University, Des Moines, Iowa

In scanning the history of science in its many-fold aspects we are impressed with the emphasis on its respective phases in different periods of its development. We have had the era of Astronomy, Physics, Chemistry and Biology, but it is likely that if the history of science is reviewed 500 years from today the 20th century will probably stand out as the Psychological Era.

Not that these other established sciences are passing but rather that they are finding fulfillment in this new field known as the science of human behavior. Psychology because it employs the same scientific methods as constitutes the basis of other sciences is considered today a science on par with other fields of investigation.

The Physicists, for example, analyze to the minutest detail the composition and organization of matter in all of its diverse forms and relations and in his quest for the cause of physical behavior returns with the exclamation "I cannot find energy." This discovery is not an admission of defeat in scientific research but rather a confession that reality lies in the realm of the intangible.

The Biologist in search for the basis of the physiological behavior in man and animals disects the tissues of the organism to discover the structure and function and their relation to the whole, and he too returns with the same refrain, "I cannot find life."

The Psychologist, no less, after a careful examination of the structure and function of the nervous system and the evaluation of behavior under controlled conditions comes to the same conclusion, namely "I cannot find the mind."

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*An abridgment of the material presented before the American Academy of Optometry, at Chicago, Illinois, December 8, 1941, for publication in the October, 1942, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

Whether we seek an explanation for *energy, life* or even the *mind* itself, in every case we will discover the nature and characteristics of these intangibles through behavior of one kind or another. On the basis of this assumption, we conclude that Psychology which aims to interpret the manifestation of human nature gains its information about the mind by evaluating the behavior resulting from adjustment itself. If behavior is an answer to wants and if the mind is discovered by a careful evaluation of such behavior it becomes apparent that the study of the human eye as a motor organ becomes the logical approach to the study of mental processes.

The eye as a sensory-motor organ, next to our heart and mind, is our most coveted possession. When we recall that during normal observations the eye fixates from 150 to 350 times per minute and that an equal number of excursions are made in the same period of time, we are impressed with the importance of this, our major sensibility. If these eye-movements were converted into sound so that we could hear ourselves and others see (which we now can) it would be like listening to a machine-gun in action. These unconscious adjustments of the eye to the demands of the physical conditions of the environment and the Psychological demand of the individual make the eye the coveted avenue to the study of the higher mental processes.

The three major determiners of seeing as we know them are: (1) the physical field, commonly known as the stimuli from without; (2) the physiological, constituting the structure and function of the receiving mechanism (the eye) and the nervous system; and (3) the psychological, comprising of such processes as may result from the inter-action of (1) and (2). Since the physical, physiological and the psychological determiners are all highly significant in evaluating mental conduct it shall be the purpose of this paper to present a scientific approach, OCULAR PHOTOGRAPHY, to the study of ocular performance and their psychological implications.

In seeking a relationship between ocular performance and their psychological implications one is confronted with at least three theories. One theory contends that poor central processes are due to inefficient eye movement habits and that special training in eye movements will result in more efficient ocular performance. A second one professes that eye movement habits are not the cause of mental activity but rather symptoms of the nature of the central processes and a third hypothesis assumes that there exists a functional relationship between ocular per-

formance and cortical activity. This third view recognizes (1) that the receptor and effector are necessary parts of the biological equipment to produce mental activity. And (2) that the mental processes determine certain motor adjustments.

Based on these theories there is, as we would surmise, a controversy in procedures of eye training and mind training. One school believes that the way to improve ocular performance is to train the eyes while another school believes that to think correctly is to see correctly and efficiently. Those of us who have been studying the eye in innumerable adjustment situations feel that there is no controversy whatsoever as long as we understand the underlying principles. Although we believe that motor performance of the eyes is symptomatic and indicative of central mental processes we no less contend that adequate ocular performance is highly significant under any circumstances.

Efficiency and Ocular Performance

With the ever increasing complexity of the demands of the social order, manifested by the multiplication of books and periodicals, the profusion of advertisements in local and national publications, and the increasing number of fast moving vehicles and machines, visual efficiency is becoming more and more essential. It is for such reasons that a scientific evaluation of how we see and how we should see is a matter of chief concern to every one.

We can hardly expect to place our hand or focus our eye on any phase of modern life but what we recognize an invention to facilitate human adjustment. Telephones, typewriters, fountain pens, radios, refrigerators and comptometers, all in one way or another have increased the efficiency of the human organism many-fold and have provided for expressions unknown to our predecessors.

Whatever the human mind learns for purposes of adjustment is, as a rule inadequate, inaccurate, and inefficient unless properly directed in the initial and subsequent stages of acquisition. Whether this be playing a piano, operating a press drill, running a typewriter, or playing golf makes little difference.

If directed training is practical and profitable in industry and play it would seem feasible that ocular efficiency could be increased if the motor processes were known.

Ocular Photography

The ocular motor process can today be discovered and evaluated

by means of ocular photography. This is a comparatively new science but by means of this technique every fixation as well as every excursion of the eye is recorded revealing not only the course the eye traveled but in addition specifying the location, duration and sequence of each fixation and measured in units of 1/100 of a second. The science is characterized by the fundamental principle of an objective record of ocular performance and as such yields data indispensable in the interpretation and evaluation of human behavior.

Since 1937 when the author first released information relative to a new mono film bi-dimensional camera the eye movements of thousands of subjects have been photographed.[1]

The new instrument of precision developed by the author is simply a 35 mm. film moving intermittently at a constant rate.

Fig. 1. A Portable Mono-film Bi-dimensional Eye-Movement Camera.

This camera provides an exact record of the ocular pattern resulting from the observation of a given field. It records the duration, location and sequence of every fixation as well as the direction and distance of every excursion. The photographic record when projected upon the originally observed content yields exact information relative to the

[1] Brandt, Herman F., American Journal of Psych., Vol. 49, No. 4, October 1937, Page 666-70.

amount of time spent in respective areas. The camera is easily operated and is portable in construction thus making it accessible to schools, offices and laboratories alike.

Characteristic Ocular Performance

Ocular patterns are as individual as the speech or walking patterns of every human individual. However, certain characteristic eye movements are common to all. The discovery of these principles provides valuable information for the analysis and interpretation of Ocular performance.

For purposes of illustrating the ocular performance of subjects under specified conditions, three scientific studies will be presented. As stated earlier the physical, physiological and psychological conditions determine ocular performance and an evaluation of each is essential in appraising human behavior.

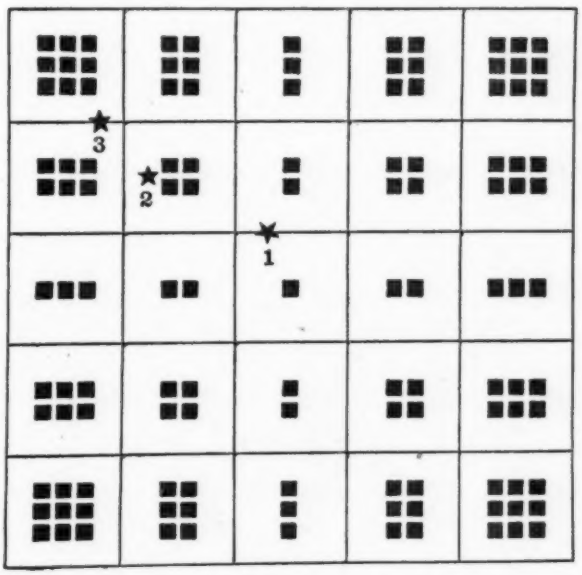

Fig. 2. Median location of first, second and third fixation of all subjects viewing exposure card.

EXPERIMENT I

To discover characteristic ways of ocular performance the author selected 50 subjects at random and instructed each subject to observe an exposure card and memorize the patterns with the intention of recall-

ing the material later. Each subject viewed the card for a period of 20 seconds but was not informed of the length of the exposure time.

It is apparent from figure 2 that the arrangement of the black square in the field would provide no preference stimuli for Ocular patterns resulting from its observation.

The median for the first fixation of all subjects, as indicated in figure 2, was located at a point above and to the left of the center of the card. This point is generally known as the optical center. The median of the second fixation is located up and to the left of the original fixation and the median of the third fixation is located still closer to the upper left hand corner than either (1) or (2).

Figure 3 is a typical ocular pattern and illustrates certain of the characteristic eye movements: (1) The eye fixates approximately four times per second and executes an equal number of excursions in the same period. (2) Two major types of ocular performances are common: One known as the exploratory in which case the eye surveys the general field, and a second in which detailed examinations are made of an area. (3) As a rule not more than three or four fixations are made in succession without changing the direction of the Ocular Course. (4) The frequency and distance of the excursions in the horizontal plane are greater than those in the vertical direction and constitute a ratio of 2:1 respectively.

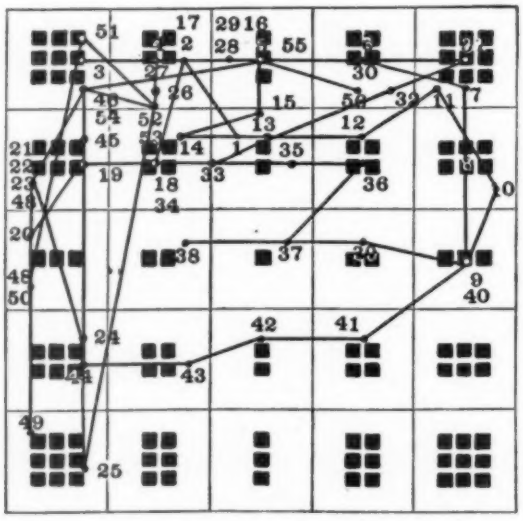

Figure 3. A Typical Ocular Pattern.

As indicated in figure 4 the number of fixations on the left half of the field is 65.89 per cent and 34.11 per cent on the right half. The upper half of the field is preferred in the ratio of 61.33 per cent to 38.77 per cent for the lower half.

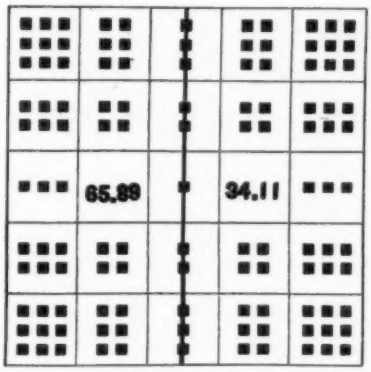

Figure 4. Percentage of time devoted to the left and right position of a symmetrical field.

TABLE I

Relative Frequency of Fixation in the Different Sections of the Visual Field, and the Relative Frequency and Distance (in Cm.) of the Horizontal and Vertical Excursions.

Position	Mean	S.E.m	M. diff.	S.E. diff.	C.R.
Left (freq.)	41.86	1.87			
Right (freq.)	20.12	1.61	21.74	2.15	9.35
Upper (freq.)	40.62	1.43			
Lower (freq.)	22.98	1.85	17.64	2.58	6.82
Horizontal (freq.)	35.34	1.6			
Vertical (freq.)	20.96	3.4	14.38	.848	17.0
Horizontal (dis.)	1955.98	102.1			
Vertical (dis.)	1093.05	86.1	862.93	16.31	52.8

Based upon these findings it is apparent that there is a strong tendency for left and top preference and the facilitation of horizontal and the inhibition of vertical eye-movements. This condition affects both the distance and direction of each excursion.

It would seem logical to conclude from data obtained in this study that position is an important determinant of ocular performance. This

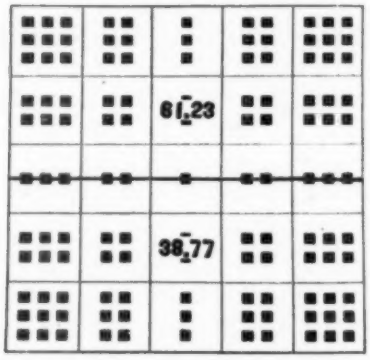

Figure 5. Percentage of time devoted to the upper and lower half of a symmetrical field.

is significant first, because it implies that one type of performance is preferred over another and secondly, because it raises the question of the why of such performance. Is it due to the acquired habits, the physiological structure of the sense organ, the neurological organization or a combination of the three? While it is generally conceded that the habitual tendency to express a left side preference is due to reading habits. A neurological theory based on experimental evidence has been advanced by Dallenbach and his associates.[2]

They believe that left side preference is due to a right or left brain dominance of the observer. Accordingly: "neural excitations aroused in the right retinas of each eye—the areas stimulated by objects occupying positions to the left of fixation—center in the right hemisphere of the brain where they, because right hand people are left brained, are comparatively free from interference and inhibition by other concomitant processes. As a consequence, they possess on the side of consciousness a high degree of perception, i.e., clearness or vividness. Everything else being equal, objects arousing processes in the right brain would enjoy therefore, a perceptive advantage over all others."

Whether we accept one or the other theory, or both, for the "why" of characteristic ocular performance is not as significant in the interpretation of the phenomenon as the fact that under specified conditions certain ocular patterns ensue.

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[2] H. A. Cohn and J. W. Papez, A Comparative Study of Visuosensory or striate area in two hemispheres of the human brain, *American Journal Phys. Anthrop.*, 14, 1930, 413f.

The frequency and duration of fixations constitute measures of protensity while excursion distance and direction imply extensity (space distance.) Both are a type of dimensions which may be measured by means of laboratory instruments. Ocular patterns resulting when observing a given field are due to native and acquired behavior patterns. What by nature the eye prefers to do and what by compulsion it will do can only be revealed by a scientific study of the eye as a sensory-motor organ.

If these findings have practical application then artists, educators, advertisers and editorial writers alike may attach a relative attention value to respective areas of a given field. Then by the proper organization of the visual field they may aid the observer to gain with a minimum effort a maximum of information and satisfaction during his observation.

An adequate layout whether of printed or pictorial nature based upon these principles of observation would naturally organize the physical layout to facilitate the idea or purpose of the observer in gaining his desired end.

Learning and Ocular Performance

EXPERIMENT II

In order to evaluate by means of ocular photography certain phases of the learning process, two exposure cards were prepared (see figure 6 and figure 7). Cards A and B were identical in structure except that all symbols were revised in their respective positions.

Forty-five subjects, 21 men and 24 women, observed card A while 45 subjects, 25 men and 20 women, observed card B. Each subject was instructed to observe the cards with the intention of reproducing the four designs on the card later. Each card was exposed for a period of 10 seconds but no subject was informed of his time limit. The size of the exposure card was 14 inches square with designs four inches high. If a subject reproduced correctly each figure, in the correct location, he obtained a score of 12 units.

The questions for which answers were sought by employing Ocular Photography were the following: (1) Does a relationship exist between time spent and the achievement of material presented in one position as compared to that presented in another? (2) Are ocular patterns of subjects of high achievement characteristically different from those of subjects of low achievement?

Results—To facilitate the interpretation of the answer to question one above the distribution in percentages of time and achievement are presented in figures 6 and 7. (The number above each design represents in per cent the relative time devoted to study the configuration and the numbers below the designs represent the relative achievement for respective areas.)

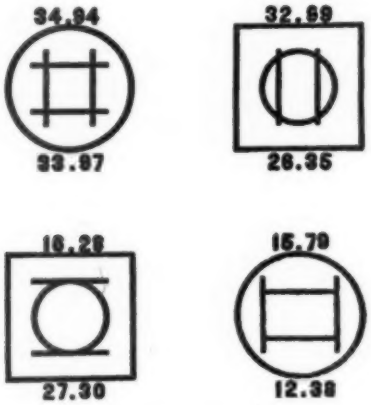

Figure 6. Percentage of fixation time and achievement in respective areas on exposure Card A.

Figures 6 and 7 indicate that achievement is significantly greater in those areas where subjects spent the greater portion of their time.

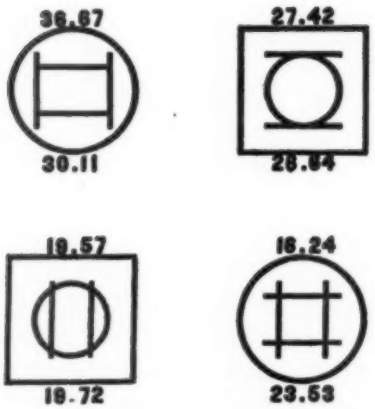

Figure 7. Percentage of fixation time and achievement in respective areas on exposure Card B.

TABLE II

Average Fixation Time Spent in Upper-left and Lower-right Hand Position for Designs 1 and 4.

Design	Card	Position	M	S.E.	M. diff.	S.E. diff.	C.R.
1	A	Upper-left	3.49	.15	1.86	.18	10.33
1	B	Lower-right	1.63	.11			
4	B	Upper-left	3.67	.17	2.90	.21	9.95
4	A	Lower-right	1.58	.12			

It is apparent from Table II that significantly more time was spent on designs 1 and 4 when appearing in the upper left-hand area than when appearing in the lower right-hand position.

Table III supports the assumption that a longer time devoted to study in certain areas (other things being equal) yields a greater achievement. Both time and achievement are greater for designs appearing in the upper-left hand area than those appearing in the lower-right hand position.

TABLE III

Relative Achievement in the Upper-left Hand and Lower-right Hand Position for Designs 1 and 4

Design	Card	Position	M	S.E.	M. diff.	S.E. diff.	C.R.
1	A	Upper-left	2.38	.15	.87	.23	3.79
1	B	Lower-right	1.51	.18			
4	B	Upper-left	1.93	.13	1.06	.20	5.30
4	A	Lower-right	.87	.15			

The answer to the question whether ocular patterns of subjects of high achievements are characteristically different from their competitors is tabulated in Table IV.

TABLE IV

Relative Time Spent in Respective Areas of Given Fields to Achieve One Unit of Subject Matter

Card	Design	1	2	3	4	Total
A	High Ach.	1.19	.81	1.46	1.19	1.17
	Low Ach.	1.93	.93	2.46	4.06	1.93
B	High Ach.	.80	1.21	.92	1.74	1.17
	Low Ach.	1.64	2.07	3.91	2.08	2.18
A&B	High Ach.	1.02	.98	1.22	1.53	1.17
	Low Ach.	1.82	1.52	2.91	2.44	2.05

The results as indicated in table IV reveal that subjects of low achievement devote nearly twice as much time, 2.05 seconds, to acquire one

unit of subject matter as compared to their superior competitors, who devote only 1.17 seconds to achieve one unit of the same type of subject matter. This same ratio is obtained when computing the fixation frequency and excursion distance. The correlation is 92 and 96 respectively.

Conditions which influence and determine the character of ocular patterns in learning situations are the intellectual capacity of the learner, the character of the field to be observed, the nature of the problem, the past experience of the learner and the purpose of the learner at the time of observation.

Implications—For all types of subjects and contents studied, a number of common factors in ocular patterns exist. Ocular movements have a common purpose, and that purpose is to gain for the individual such orientation as will be best for his present need. It follows that many psychological processes operate. Each excursion implies judgment and discrimination on the part of the individual. The sequence of each fixation follows (if a definite purpose is presented, as in learning) a procedure which leads to the goal set by the learner. Not only judgment but a definite inspection and selection of content are involved.

Excursions imply additional psychological operations which function in terms of retentions and have a future reference. These are expressed in the learner's discovery of relations which exist, or which according to his interpretation should exist between the components or stimuli presented. Continuing the search for additional relationships naturally calls for a type of organization which will be both analytical and synthetical and which may unify the content studied.

Organization in this sense of the term is no longer an abstract idea. It has meaning in terms of the ocular performance in which it reveals the method and procedure of the learner in gaining the content necessary for future use. For after all, what the individual learns in terms of relationships is his own creation and will stand or fall as a result of its construction. To see relations is the privilege of the human race. It borders on the subject of how we think or how we should think.

By means of this technique the level of learning efficiency may be ascertained by comparing records of earlier and later stages of performance. Based upon such findings new types of presentation could be developed to aid the learner in gaining a maximum of information with a minimum of time and effort.

Foveal and Peripheral Vision

The manner in which we see has, we believe, an important bearing on our abilities in different vocations. If one employs peripheral vision, as a rule the type which attempts to see the whole situation at a glance, chances are that such an individual would make a good basketball or football player because in those sports a more comprehensive view is essential.

Persons with this type of vision are likely to make good automobile drivers and have fewer accidents. It is the man who can see behind, in front and at the side as well, who rides most safely. This type of vision is especially useful in situations which demand quick orientation. It is a mechanism for protection, where instantaneous changes and adaptations are necessary. It is indispensable in many vocations.

People who use foveal vision, in the main, use their eyes for accurate differentiation and discrimination. Individuals of this type make poor athletes. They are at a loss in situations which demand quick adjustments and adaptations. Lawyers, teachers, mechanics, dentists and optometrists need vision of this type.

Throughout all the possible psychological implications of ocular performance when related to learning is found that of the relative function of *foveal* and *peripheral* vision.

Experimental psychology has demonstrated beyond a doubt that the fovea is the area of clearest and most distinct vision of the retina, and although this area is only about a millimeter in diameter, it serves a very necessary function in gaining accurate information for the individual from his environment.

If both foveal and peripheral vision have a role to play in the acquisition of information, commonly called "learning," then it becomes our duty to investigate the relative function of each in order that we may determine when and to what degree each should be employed in the learning process.

As a result of this investigation, the author has come to the conclusion that we have gone peripheral in our educational procedures. Because of the emphasis on speed, the visual mental adjustment employs peripheral vision and therefore tends to replace accuracy by impression, and in turn generates inadequate perception, poor memory, inaccurate reasoning and bad mental habits. It may even lead to disordered conduct

and a warped personality. This is especially true for those who, with only limited intellectual and physical capacities, are compelled to compete with their superiors in the marathon of educational demands.

The school of speed to which a large per cent of modern educators belong, believes, that since the periphery is a much larger area than the foveal area, it should find a much greater place in training the child than is the case in present practice.

If accuracy is a major quality of perception, and if the adequacy of mental processes depends on the character of this mental content, then we need to inquire, from data obtained under scientifically controlled conditions, what form of ocular performance we desire in order that the learner may gain the maximum information with a minimum of action.

The ocular patterns for contents when superimposed on the original content materials, evidence a certain degree of judgment in fixation, location and direction of excursion. Does the subject fixate on essentials or non-essentials? Does he make only surveys or does he concentrate? Is he systematic or does he ramble?

It is my belief that accuracy generates speed but the postulate that speed will generate accuracy does not seem feasible. This is the order in motor as well as in abstract learning. Regardless of the point of view, no method of acquisition is to be recommended or accepted which destroys accuracy.

Based upon the native capacity of an individual, there is a very definite rate and limit of speed of perception and cognition. Each new stimulation has a latent period of incubation and a period of more or less incompletely inhibited development before it reaches full maturity. The clearing-up process varies with different individuals and may be said to begin with the new stimulus and terminate whenever it is differentiated from its predecessor.

Whenever the normal speed of the subject is exceeded he is penalized in terms of inaccuracy of recall, in terms of acquiring impressions for indiscrimination, and is robbed of the self-confidence which follows when one is correct in the solution of a problem.

The question arises shall we prepare youth for a type of life where the stop watch is the barometer of success or shall we attempt to provide an atmosphere in which an individual may work at a speed geared to his capacity and thus develop continuity of thought, accuracy of observation and a normal personality.

There is grave danger in this emphasis. It may lead to disordered conduct and warped personalities. This is especially true for those who with only limited intellectual and physical capacities, are compelled to compete with their superiors in fulfilling educational demands.

Both forms of vision need to be coordinated in education and the correct proportion is only to be determined after intellectual level and vocational aptitudes have been ascertained.

The psychological implications of ocular patterns as applied to the relative emphasis of foveal and peripheral vision constitute one of the major unknown factors in the intelligent interpretation and direction of the learning process.

Even if this difference is only a matter of emphasis, it no doubt determines to a large degree the selection of subject matter and methods of presentation. It may even determine the philosophy underlying the purpose and alleged function of educational procedures. In fact, such a concept might be responsible for the birth and perpetuation of an entire system of education.

Ocular Performance and Interests

We attend to that which interests us and as a rule we are more interested in that to which we attend. E. K. Strong of Stanford University based his "Interest blank" on the following assumption. "Men engaged in a particular occupation have been forced to have a characteristic set of likes and dislikes which distinguish them from men following other professions." He believes that the scores which individuals make on his scale are a measure of how nearly a man's interest coincides with those successfully employed in the vocation.

If interests are symptoms of abilities and if we attend to what interests us, it seems feasible that such interests can be discovered by means of ocular photography. Interest and attentions are coextensive in that they constitute the experience itself. Schools and industries must ultimately reckon with this human attribute, and if the scientific study of ocular performance will throw light on this vital phase of human adjustment this technique known as ocular photography shall have served a valuable end.

Since interest is associated with a feeling of worth and since we are inclined to do what we like and avoid that which we dislike it is likely that the ocular pattern would yield a fairly adequate picture of our unconscious deep seated desires in this respect. Interests as such are

not superficial but are based on a neural organization which owes its source to the native capacity as well as to the acquired habit patterns of the human individual.

EXPERIMENT III

In order to determine sex interests the author selected 100 college students, 50 men and 50 women at random and permitted them to observe a two page spread from a mail order catalog. One page comprised objects (cosmetics) such as would be likely to interest women and the contents of the other page consisted of supplies such as would be likely to interest men. In order to eliminate the position variable the pages were reversed for the two parts of the experiment. Each subject observed only one exposure card for a period of 15 seconds. Subjects were not informed of a time limit.

Figure 8. Relative time in per cent spent on respective areas by men and women when observing the above exposure cards.

Results

Figure 8 and 9 indicate that the male subjects spent 61.00 per cent and 64.20 per cent respectively on items of their interest as compared to 39.00 per cent and 35.80 per cent on items of female interest, while the women spent 59.13 per cent and 60.53 per cent respectively on items of their choice in preference to 40.87 per cent and 39.47 per cent on items of male selection. The male interest is more pronounced

than that of the female. This may be due to the fact that women purchase 80 per cent of the general merchandise for the home and thus show more interest in men's merchandise than men do in women's merchandise.

Figure 9. Relative time in per cent spent on respective areas by men and women when observing the above exposure cards. (Position of merchandise reversed.)

TABLE V

Relative Time Spent by Male and Female Subjects on Areas of Their Respective Interest

Sex	Area	M	S	Sm	M. diff.	S.E. diff.	C.R.
Male	Cosmetics	5.63	2.89	.60	3.74	.84	4.45
	Shaving	9.37	2.89	.60			
Female	Cosmetics	8.98	3.06	.61	2.96	.85	3.48
	Shaving	6.02	3.06	.61			

The results of this study show that the women spend an average of 6.02 seconds on the male supplies and 8.98 seconds on supplies commonly used by them.

The male subjects, on the other hand, spend an average of 5.63 seconds on the supplies commonly used by women and 9.37 seconds on paraphenalia commonly used by men.

Based on the results of the above studies it is clear that a subject will spend more time on those objects in which he or she may be inter-

ested. To evaluate and announce our own interests is in most cases impractical and unsound. It in many cases yields preferences which are supported by rationalization or a type of justification for a choice and which in reality are not truly representations of the real unconscious tendencies.

Since interest implies previous experience in terms of information, a degree of familiarity, a sense of satisfaction or a feeling of worth and advantage, an inherent set of aptitudes and an active effort to respond to respective situations is established. Ocular photography may be the logical approach to the scientific study of this important problem of human adjustment.

The degree to which these interests may be discovered will depend largely on the adequacy of the design of the experiment itself. To know that human interests exist and to discover to what degree they function is to create a physical setting in which individuals have an opportunity to express their preference and thus be objectively evaluated by means of this new technique.

It is likely that by means of this approach we shall discover clerical, mechanical, social and art abilities of human individuals which will predetermine the type of training necessary as well as the selection of a vocation properly adapted to the respective interests, capacities and abilities of respective professional and non-professional men and women. Such ocular patterns may constitute a graphic representation of human inclinations and desires, and if properly obtained will yield valuable information for teachers, parents and vocational counselors alike.

Conclusion

This paper is an attempt to present a scientific approach to the study of human behavior. The three experiments reported in this paper are an attempt to illustrate the possibilities of evaluating ocular performance and their psychological implications by means of photography.

It is the belief of the author that psychology will play an increasingly larger role in the practice of optometry in the future than it has in the past and ocular photography is likely to provide the link between the two. Psychology, although only a youngster among the sciences, is destined to make unprecedented progress due to the fact that it has at its disposal such highly developed sciences as physics, chemistry, biology and engineering. Even if seeing is a physiological phenomenon it nevertheless is fundamentally psychological in operation. To see is

to perceive and interpret whatever is observed and the optometrist who can fashion for his patient a clear or more accurate image is without a doubt assisting the psychological processes involved. If due to the corrections his patient can read more rapidly, perceive more accurately and learn more adequately, he may consider himself a psychologist who is in a position to facilitate mental psychological processes. An optometrist besides being a refractionist may well consider his work a necessary link in the whole scheme of educational effectiveness, industrial efficiency, personality development and social integration.

Innumerable reports from teachers and parents indicate the change and improved behavior due to corrected vision. This is not at all surprising since most of our mental imagery is visual in character and deficiency of this avenue deprives a subject of the major portion of his mental content.

In reality, we do not see with our eyes. These provide only an avenue for sensory experience which becomes reality as a result of the interpretation of the human mind. This is the material which constitutes the real seeing content. Only after the sensory experience has passed these stages is it ready for practical consumption.

To aid the mind at work is to follow through with procedures far in advance of fitting ophthalmic lenses. It is a means of aiding the intricate nervous system in complicated mental adjustment processes and to equip the individual with enriched visual experience which will flower in educational and industrial efficiency and a well rounded personality.

The modern optometrist will confirm, if at all possible, the condition under which his patient works. He will want to make certain what visual skills are demanded of him and whether night vision or daylight vision is demanded. Does the job require depth perception, pursuit movements, near vision, detailed discrimination or exploratory observation? To make an ophthalmic correction without determining, at least to a degree, the visual motor requirements of the patient so treated is like providing a man with a gun without any consideration of what he expects to shoot.

To observe the ocular performance of an individual with defective vision by means of ocular photography before and after correction may be a unique revelation. To see a permanent record of an ocular performance when the subject is fatigued, under the influence of drugs or

under adverse lighting conditions provides new frontiers in the science of optometry. Optometry as a science of seeing is destined to join hands with psychology in its quest for a solution to efficient and effective ocular performance.

For an optometrist to see beyond the mere visual mechanism known as the human eye and to study its behavior in the light of adjustment with a purpose, is to see the mind at work.

DISCUSSION

DR. R. J. BEITEL, JR., SOUTHBRIDGE, MASS.: I think we will all agree that this paper has been most interesting and enlightening.

Before discussing it further, I want to say that Dr. Lewis Kraskin could not be here to take part in the discussion and wanted me to bring out one point in which he was interested; that is the possible use of a method of this type in evaluating emotional stability of an individual.

I wonder, Dr. Brandt, whether or not that has been considered from the standpoint of visual free association tests. As you know, one of the methods presented in psychiatry is to present a word and have the patient respond with the first word that comes to his mind, and from the indicated responses they get some idea as to the trend of thinking and possibly can get from their unconscious attitude or impulses an indication as to what it may be that is bothering these individuals.

Dr. Kraskin was wondering whether or not putting pictures or words or ideas, in pictorial form before the patient, and then photographing the eye movements whether the neurotic or emotionally unstable individual might show characteristic tendencies differing from the normal.

Certainly emotions do affect ocular behavior. In some work on anxiety done at New York University, photographing eye movements, it has been found that there is a complete disturbance of reading performance as shown in the eye movement pattern when an individual is told that he will be shocked or receive an electric shock while he reads, yet the shock is not given to him. The anxiety created is the thing that disturbs the ocular performance.

I am sure it was interesting to all of us to see that for some reason eye movement behavior has a common element or similarity in the way an individual will attack a group of even symmetrical figures or an advertisement.

I do feel that the value in raising a question of similarity or dif-

ferences comes out as Dr. Brandt says, in "the possible use for it in developing educational technique." For example, if one photographs eye movements of all types of people, and finds the best readers and sees what characteristics are present in the best readers, and attempts to develop poor readers into the proper methods on the assumption that the better readers show the better methods of eye performance, you will have developed an educational technique.

I know you have done a good many experiments in developing this point of similarity in functions, Dr. Brandt, but I am wondering what effect you would get in arranging a series of squares that have no symmetry but are all equal in appearance in each block. Is the attack of order the same?

You see you have certain cues of arrangement. I wonder whether the attack is the same or is there something in the symmetry of the picture which influences the ocular performance?

I wonder what would happen if the subject were informed that he has only twenty seconds to acquire this? Would the method of attack change when the individual knows that a time limit has been imposed upon him?

It becomes an important factor in evaluating educational technique. I know in certain experiments in reading training, when subjects were given two different methods of training, were told that at the end of the training period a given test selection is made, one group is told that they have to work under time pressure, and the other not, that the relative effectiveness of given training periods could be readily shown when the better individuals were placed under time pressure.

In your work in evaluating advertisements, I wish you would describe your method. I think it is highly interesting, that is, the number of subjects used in evaluating certain types of ads and the types of subjects.

I have this comment to make about the use of it as an indication of intelligence. We saw in some of the material presented that the rather unintelligent or poor student advanced in random fashion, excess of idle movement, compared to the superior approach.

DR. HERMAN F. BRANDT, DES MOINES, IOWA: I do not think that I can answer all of those questions, Dr. Beitel, as time does not permit, but I shall try to make an attempt here, taking them in the order in which they were asked.

We are now setting up an experiment for the psychogalvanometer, for use when the individual looks at the advertisement. We use a number of cameras, and we have all the indices for the reactions of these people and also have the psychogalvanic reading. We have very definite indications that there is a certain amount of emotion developed when a person sees certain things. We know this holds certain values for both advertising and art.

I have been particularly interested in how artists and non-artists look at a picture—findings of that type. Here we find out something about esthetics. There is a conflict of biological, on one hand, and social restraint on the other. It isn't so much that you have a conflict, but how you resolve it. We will probably find as this individual comes into that field that we will have that kind of emotional experience, and that would seem to me to be a very fine study in that connection.

The other question I am not sure whether I am quite clear upon. There was some similarity about the symmetrical field in which they work. I might say we have used all kinds, shapes and sizes of fields, but the one thing we do find has to do with time; and that it makes a big difference what idea is in the mind of the subject. For instance, you tell an individual just to look at a symmetrical field. What is he going to do?

If we inform this subject just what it is we want him to do, we know that his ocular pattern is going to be different from that found if we just say, "look." It is one thing to look at and another to look for. You don't always see when you look, but have to look if you want to see.

Then the other question has to do with time limit. Time does make a big difference. If we tell these subjects that they are going to look at a test object for ten or fifteen seconds, or even that we have a time limit, they become upset or neurotic; there is an adjustment which must be made rapidly. That is why most intelligence tests have a question mark back of them. We realize, however, that time and speed are very important.

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SOME COMMENTS AS TO THE POSSIBILITY OF A REDUCTION IN HYPEROPIA, DUE TO EMOTIONAL DISTURBANCES

As a basis of interesting speculation, the writer wonders, just how much, prolonged emotional disturbances can affect ocular refractive mechanisms. For instance, the concern over impending economic changes as the result of war. The mental suffering of thousands whose loved ones are in military service. The changes in the lives of many due to war-time activities, and the ever increasing nervous tension as the result of war responsibilities, may have a marked reaction upon neurological systems as a whole, which in turn may possibly be reflected in a comparative study of the pre-war and present day refractive findings of many individuals.

Whether or not such changed ocular conditions exist is not known. Ocular literature presents but little if anything, and again there is naturally some doubt that uncontrolled refractive findings, made as these are in our refractive rooms, are delicate and accurate enough to serve as a guide, or to permit us to use these findings as a diagnostic screen. And if they are, of what diagnostic values are these findings, if and when accepted?

The matter is brought to a focus around one unusual and perhaps significant refractive finding. In the writer's practice, his attention has been drawn to the fact that during the past 18 month period, a small but nevertheless not to be ignored group of 19 patients, has indicated an unlooked for and possibly significant refractive finding which can be explained in no ordinary manner. This small group of cases, by no means conclusive of anything, may however indicate something which we, as optometrists, should be watching for and also which may be of value to us at a later time. At present its significance, if any, is unknown.

This material is presented only inasmuch as these early clinical data are at hand and that it should be worth further study and attention. Mention too, should be made of the findings, not because of any far reaching diagnostic value which might be attached to these, but rather to provoke a more widespread interest in the subject and to introduce in our literature, the fact that in some few patients these refractive changes have been recognized, even though their significance is as yet a speculative matter.

The refractive changes which have been noticed in this small block of patients are as follows. The patients fall entirely within the age group of patients between 33 and 52 years. Both men and women are included in the group. All patients are hyperopes of relatively low degree with little or no astigmatism. Some are in the early stages of presbyopia. These cases were all apparently (from a clinical standpoint) corrected in a satisfactory manner from two to five years ago by the writer. As a group, they used their corrections more or less constantly and were reasonably free from symptoms, until they noticed that with their glasses in place, their distance vision had become poorer than it had been some time in the past.

These cases experienced no near-point symptoms. And in presenting themselves for a re-examination all emphasized the fact that it was the distance vision disturbance or symptom, with the correction in place,

which seemed to need attention. In most cases the former case record chart of these patients showed that they had normal or nearly normal distance vision, both corrected and uncorrected. On the other hand, the new refractive findings indicated that while they accepted their hyperopic corrections for the near-point, they accepted considerably less plus sphere than before at a distance.

At first glance it might be assumed that these patients might be developing pseudo-myopia, but to date at least none of the cases has developed to a point where a concave lens would be accepted, or would be of value, in improving distance vision. Then too, the age factor is against this assumption, as is the fact that in most of these cases the patient is now, and has been doing but little near-point work.

In all of these cases, the ophthalmoscopic examination, visual fields, external inspection of the eyes were negative, as was the case history. The patients were, as far as they knew, in good physical condition. The near-point accommodative findings were, in almost every case, about the same as before, as were the phoria and duction findings, yet we found the distance acceptance of convex sphere varied from +0.37 D., to +0.75 D., always to the lower side.

Glaucoma was suspected, yet aside from the changed refractive finding there was no other symptom or factor which might confirm such a diagnosis.* All of these cases are kept under observation because of this point.

Diabetes too, was suspected although in every case the crystalline lens was free from any evidence of opacity. At our request, five of these cases had an analysis made of the blood sugar, which in each case was negative.

All of these cases are now using their new corrections, either weaker single vision corrections for constant use, or bifocal corrections with less convex sphere in the distance portion. They all now report normal distance vision and visual comfort.

Now why should these 19 patients refuse to accept convex corrections which they formerly accepted with comfort? It may be said that in these few cases the writer somewhat overcorrected them in the

*It has been pointed out that the refractive change usually expected in early glaucoma is a rapid increase in the acceptance of convex sphere and against-the-rule cylinders, a condition exactly opposite from that found in these cases. The writer, however, takes a somewhat broader view of the subject and includes any and all unexpected and unexplained refractive changes as possible preludes to glaucoma.

first place, and of course this is possible, but why was the over correction accepted and worn for a period of time and then why did it seem to "fog" their distance vision? As a rule it would work out in just the reverse way.

These cases seem to resemble the now famous (?) Annapolis cases in which the distance vision of these students fell off, but in fact there are several important differences. The cases referred to in the present group are all much older than the average age of the student body at Annapolis. And the present cases are for the great part not engaged in study or constant near-point work. Seven of the 19 cases are housewives, doing but an average amount of near-point ocular work. Not one of the 19 cases is really engaged in a full-time near-point activity. Nor, in the present group of cases, has vision fallen below 20/20 uncorrected, as was pointed out before. Collectively, this group of cases does but little near-point eye work. One of the patients, included in this report, is a member of a metropolitan fire fighting force, who by his own admission reads only Sports Pages. He has, however, two sons in the military service, one doing convoy duty in the mid-Atlantic.

This would seem to rule out the factor of over-use of the eyes at the near-point. Yet from a purely clinical standpoint the condition of change seems to exist in this small group. It may or may not have diagnostic significance. The findings may or may not be of temporary character. Yet some change has taken place. And the only factor to which this can be attributed by the writer, is the fact that in each of these patients, the war has brought emotional stress for them, which may have influenced the refractive conditions as indicated.†

In only one particular are both groups similar. The Annapolis group and the present group are under more or less constant nervous pressure or mental strain. Not necessarily constant ocular pressure but rather constant emotional stress, which in some patients may result in minor neurological problems which affect vision. These patients, in

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†Dr. E. LeRoy Ryer, of New York City, in a letter (July 16, 1942), comments on this point as follows: "It might be expected that the emotional strain would reduce the plus at near also. Yet, as Cross has pointed out, this reduction could be absorbed dynamically. Whatever else your cases show, they strengthen my belief that we are thinking straighter when we look upon distance findings and near findings as independent, separate, 'unshackled' entities. In these cases, however, convergence that is exerted at close points, not necessarily reading or working points, might carry over into distance vision and hold the accommodation from acting negatively. You may recall that Peckham, and later on Luckiesh and Moss, pointed out the existence of negative accommodation in the amount of 0.75 D."

both groups, may respond in this manner to their war-time reactions and in the case of the Annapolis group these students also have the nervous reactions as the result of their keen desire to stay in college. Reactions which may result in an emotional imbalance which results in a slight but uniform increase in innervation to the ciliary muscle causing the crystalline lens to become slightly more convex.

As mentioned earlier, this is just a speculation, backed only by case histories and by meager clinical findings. Certainly the number of these cases is far too small to permit specific conclusions, and the time element far too short to permit the presentation of data from which a more or less sound conclusion could be drawn. We are, however, engaged in a major war which will, perhaps without our realizing it, affect in many ways our reflexes and reactions and it is possible in some individuals our mechanisms too, may react as indicated above. The writer presents these speculations only as a possible source for future attention and study. Carel C. Koch.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

by J. Fred Andreae, Secretary

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

ANNOUNCEMENT TO ALL STUDENTS OF PHYSIOLOGICAL OPTICS

For the past two years a member of the Academy, Dr. Carl A. Radde of Cleveland, has been engaged in the translation of Ewald Hering's "Spatial Senses and Movements of the Eye."

A scientist, composer and critic of note, patron of the arts, and a student of languages, Fellow Radde has now proven himself an able translator, and it is with pleasure that the American Academy of Optometry announces its sponsorship of the publication of his work.

To Dr. Radde, the Academy wishes to express its appreciation for his valued contribution with the hope that the success of this project will serve as added stimulus for further endeavor.

This work will not only be valued for reference, but will be found

a definite aid to all teachers and students in the field of physiological optics and especially to everyone interested in the anomalies associated with normal and abnormal projection. R. M. Hall.

SPATIAL SENSES AND MOVEMENTS OF THE EYE

The Academy is happy to announce to the profession that during October, the first English translation of Ewald Hering's book, "Spatial Senses and Movements of the Eye" will be released. This newly published work is made available to all optometrists by the sponsorship of the Academy which has financed its printing.

Heretofore available only in the original German, this text will prove of great value to all students of ocular myology.

Radde is presenting to his profession a faithful translation of the original text, and one which should prove popular among all real students, both undergraduate and graduate.

The text, bound in cloth, may be secured by sending check or money order for $5.00 to the Secretary of the American Academy of Optometry, Dr. J. Fred Andreae, Lexington Bldg., Baltimore, Md.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list, although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

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11. EDUCATION, SOCIOLOGY AND ECONOMICS

ECONOMICS AND THE HEALTH PROFESSION IN PEACE TIME AND WAR. Asgis, A. J. Columbia Optometrist. 1941, 15, 60, 2-4.

Asgis briefly reviews the economic status of members of the health-service professions and finds that many physicians, dentists and optometrists, as well as their patients (both actual and potential), are none too well served with the world's goods. For this reason Asgis suggests that

the professions mentioned enter into programs of compulsory health care as the solution to the present economic problems of the practitioner and the health problems of the patient. T. O. B.

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12. MISCELLANEOUS

SAVING OF EYES IN INDUSTRY—A MANAGEMENT PROBLEM. Humphreys, F. H. Sight Saving Review. 1941, 9, 2, 130-135.

"After an active interest in the company's goggle programs for 16 years, it is my opinion that if you expect men to wear goggles, management must be willing not only to furnish proper eye protection, but also to support the goggle program, for only management can exert the pressure necessary to enforce the goggle rule." In the American Car and Foundry plant the company furnishes equipment for the protection of eyes, except prescription safety goggles for new employees, who are charged actual cost. Prescription lenses are replaced at the company's expense and all prescription lens goggles remain the property of the employees. C. C. K.

THE ALEXANDER TECHNIQUE AND ITS APPLICATION TO OCULAR MUSCLE PROBLEMS. Crundall, E. J. Optician. (London) 1941. 102, 2630, 31-32.

A new eye cult seems about to spring into being in war-torn England. The high-priest of this new ocular fad is one "Alexander" who through a system of, what are called co-ordination exercises, is claimed to do much for persons with ocular problems. Crundall attempts to review the thinking (?) of this new prophet of Bates. C. C. K.

OCULAR FINDINGS AMONG ONE GROUP OF SELECTIVE SERVICE CANDIDATES. Levine, H. Optical Journal and Review of Optometry. 1941, LXXVIII, 15, 29.

Levine examined 338 consecutive men between the ages of 21 and 35 who were candidates for military service. Thirty of these, or nine per cent were rejected because of the following ocular conditions: Choroiditis, 6; neuritis, 1; strabismus and amblyopia, 8; retinitis, 1; color blindness, 1; lenticular opacity, 2; bilateral maculae of the cornea, 2;

amblyopia, 3; exophthalmos, 2; myopia with posterior staphyloma, 3; ptosis of the lid, 1. Levine points out that some of this disability could have been prevented by early eye care. C. C. K.

SOME EYESIGHT CURES OF BYGONE DAYS. Barnett, A. Optician (London). 1941, 101, 2615, 203.

"Bygone remedies for defective vision and medicines for the strengthening the sight of failing eyes, were almost as frequently based upon superstition as upon the possible therapeutical value of their ingredients." Metals, herbs, plants and precious stones are mentioned by Barnett as former aids in eye care. C. C. K.

VISUAL STANDARDS FOR ARMY AIR PILOTS. Alpern, M. B. A review of Army Regulations 40-110, "Standards of Physical Examinations for Flying in the Army Air Corps." Optometric Weekly. 1941, 32, 39, 1101-1102.

All Army candidates subject to a physical examination for flying are classified into one of the following three groups: (1) Class 1. Applicants for and students undergoing flying training, rated senior pilots, pilots, combat observers, balloon pilots, senior balloon pilots and balloon observers. (2) Class 2. Rated senior pilots, pilots, combat observers, balloon pilots, senior balloon pilots and balloon observers who can not meet the physical standards of Class 1 but whose training and experience are of such a nature as to compensate for lower physical standards. (3) Class 3. Rated command pilots, technical observers and officers of other armed services detailed to duty involving flying.

The following are the visual tests given, and the standards necessary, to qualify in each of the three classes.

(a) Visual Acuity. Standard Snellen test at 20 feet. Test chart illuminated with 100 watt daylight mazda lamp. For Class 1, the minimum uncorrected visual acuity necessary to qualify is 20/20 in each eye. For Class 2, an uncorrected visual acuity of 20/40 is permissible provided the vision is correctable to 20/20 and that the corrective lenses are worn while flying. For Class 3, an uncorrected visual acuity of 20/100 is permissible provided the vision is correctable to 20/20 and that the corrective lenses are worn while flying.

(b) Depth Perception at 6 meters. Standard depth perception "peg" test. For Class 1, an average error of more than 20 mm., over a series of ten trials disqualifies. For Class 2, an average error of more than 35 mm., with correction worn, disqualifies. For Class 3, the test is omitted.

(c) Heterophoria at 6 meters. Maddox Rod Test. For Class 1 and 2, an esophoria of more than 4 prism diopters, when associated with an abduction of less than 4 prism diopters, disqualifies. Esophoria of more than 10 prism diopters disqualifies, regardless of the abduction. Exophoria of more than 5 prism diopters, disqualifies. Hyperphoria of more than 1 prism diopter, disqualifies. For Class 3, esophoria of more than 12 prism diopters: exophoria of more than 7 prism diopters, or hyperphoria of more than 2 prism diopters, disqualifies. An heterotropia of any variety, disqualifies for all three classes.

(d) Power of Divergence. An abduction test at 6 meters, with the subject reporting a blur before diplopia. The point of blur is recorded as the amount of prism divergence. For Class 1 and 2, when an esophoria exists at 6 meters, the abduction must equal or exceed the esophoria in prism diopters. An abduction of more than 15 prism diopters, or less than 3 prism diopters, disqualifies. For Class 3, the test is omitted.

(e) Binocular Field of Vision. A Red Lens test to map or plot the extremities of the field of binocular vision. The test is made as follows: The subject is seated in a dark room. One of the subject's eyes is covered with a red lens. A spot of light is held at the primary position, about 75 centimeters before the subject. The light is then slowly moved through the 0, 45, 90, 135, 180, 225, 270 and 315 meridians, and the distance from the primary position to the point of diplopia in each meridian is noted. For Class 1 and 2, if diplopia occurs at any distance less than 50 centimeters the subject would be disqualified. For Class 3, the test is omitted.

(f) External Ocular Inspection. A routine examination of the external eye with the hand slit-lamp or loupe. Any pathological condition disqualifies, but allowance is made for those minor pathological abnormalities which are of a non-permanent character.

(g) Amplitude of Accommodation. The push-up and recede technique is used. The amplitude is recorded and compared with the Duane Table of Accommodative expecteds for the subject's age level. For Class 1, an amplitude of less than 6.5 D., disqualifies, regardless of age. Also, an amplitude which is found to be more than 3.0 D., below the mean value for the subject's age, disqualifies. For Class 2, the subject must have an amplitude of more than 3.0 D.; however, in both Class 2 and 3,

the applicant may qualify with an amplitude of less than 3.0 D., if a near-point correction is worn while flying.

(h) Angle of Convergence. This finding depends upon two factors, (1) the subject's pupillary distance and (2) the subject's near-point of convergence, both taken in millimeters. The angle of convergence is transposed into degrees by the use of the formula ($\frac{1}{2}$ P.D. $\times$ 100) $\div$ (near-point of convergence $+$ 25) $+$ 3. Subjects with an angle of convergence of less than 40° would be disqualified in both Class 1 and 2. For Class 3, the test is omitted.

(i) Central Color Vision. Evidence of color blindness as revealed by the Ishihara or Stillings test will disqualify an applicant from all three classes.

(j) Field of Form Vision. This is to be taken with a standard perimeter using a 3 mm. target. The form fields of each eye are plotted and a constriction of more than 15° in any meridian will disqualify. These standards are the same for all three Classes of candidates.

(k) Refraction. This is done under a cycloplegic (homatropine) and consists of static skiametry with a modified subjective test. The minimal correction required for the subject to read 20/20 with each eye is noted as the refractive correction. A correction in any meridian of more than 1.50 D., or a cylinder in any meridian of more than 0.50 D., as determined by the above method, disqualifies.

(l) Internal Ocular Inspection. An ophthalmoscopic examination. Any abnormality that materially interferes with normal ocular function, disqualifies.

C. C. K.

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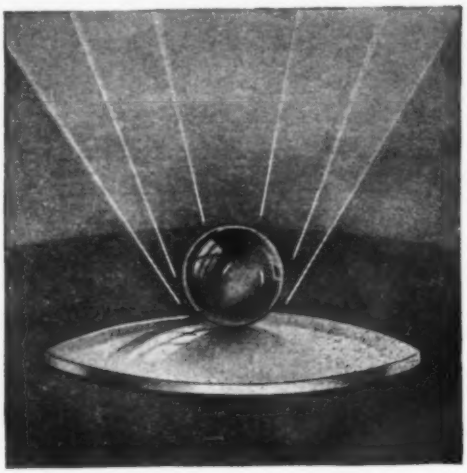

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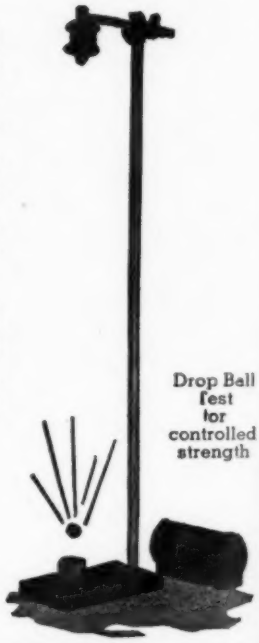

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Management and circulation as required by the Act of Congress of August 24, 1912, of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY, published at Minneapolis, Minnesota, for October 1, 1942.

State of Minnesota, County of Hennepin—ss.

Before me a Notary Public in and for the State and County aforesaid, personally appeared Dr. Carel C. Koch, who having been duly sworn according to law, deposes and says that he is Editor and Publisher of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY and that the following is to the best of his knowledge and belief, a true statement of the ownership and management of the aforesaid publication for the date shown in the above caption required by the Act of August 24, 1912, embodied in Section 411, Postal Laws and Regulations, to-wit:

First, that the names and addresses of the Publisher and officers are as follows: Publisher and Editor, Dr. Carel C. Koch, 1501-1504 Foshay Tower, Minneapolis, Minn.; Associate Editors, Dr. G. L. DuPlessis, 1501-1504 Foshay Tower, Minneapolis, Minn., and Dr. Clarence W. Morris, 232 Utility Building, Fort Wayne, Ind.; Advertising Manager and Production Manager, Mr. Harry B. Brookins, 700 South Fourth Street, Minneapolis, Minn.; Circulation Manager, Lilly L. Koch, 1501-1504 Foshay Tower, Minneapolis, Minn.

Second, that the owner is the American Journal of Optometry Publishing Association, Dr. Carel C. Koch, President and Treasurer; Dr. G. L. DuPlessis, Vice President, and Lilly L. Koch, Secretary.

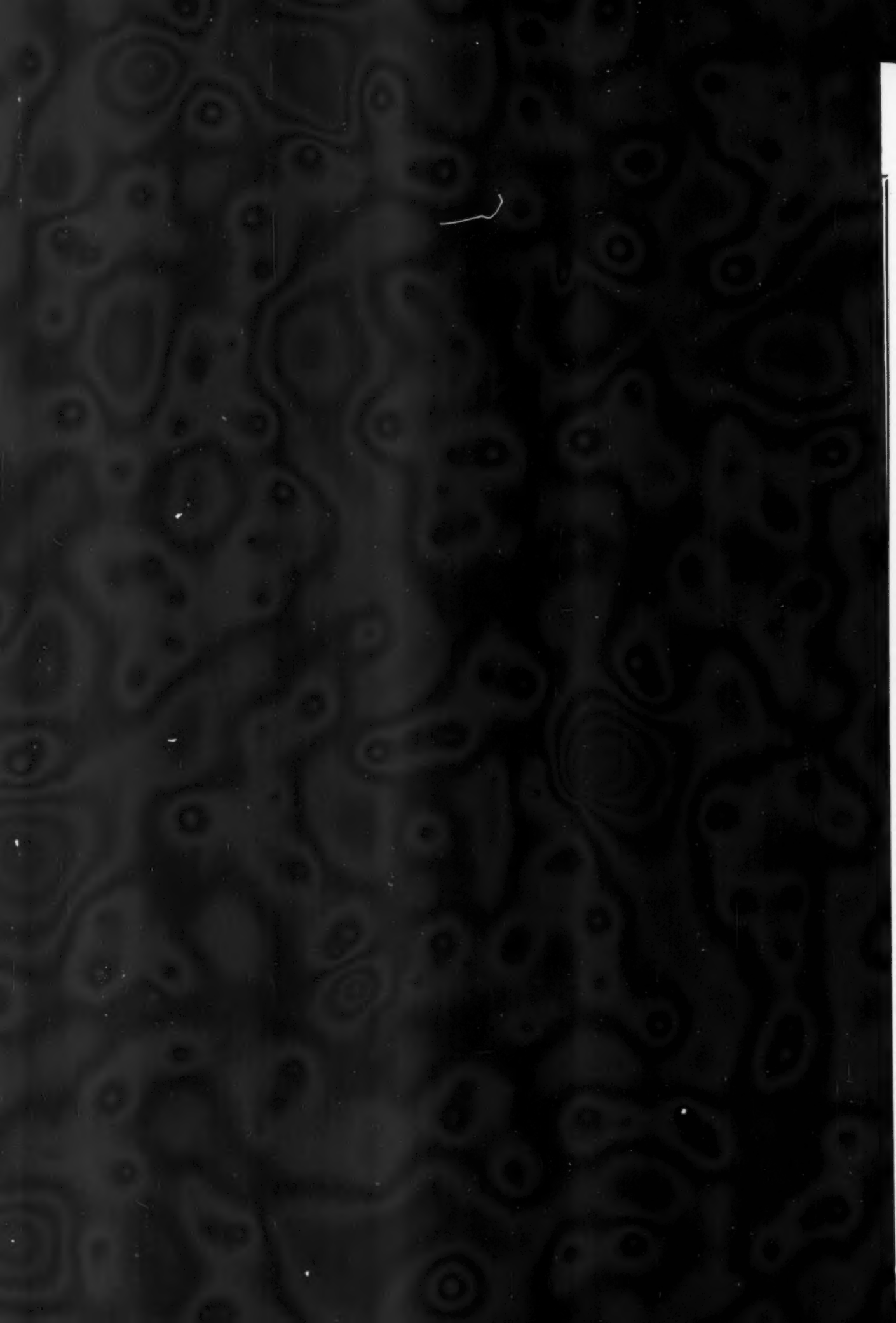
Third, that there were no bondholders, mortgagees, or other security holders owning or holding one or more per cent of the total amount of bonds, mortgages or other securities of this publication.

DR. CAREL C. KOCH, Editor and Publisher,
The American Journal of Optometry.

Sworn and subscribed before me this 17th day of September, 1942.

LILLY L. KOCH, Notary Public,
Hennepin County, Minnesota.

(My commission expires May 19, 1943.)



Light Tolerance in War-Time Refraction

Photophobia, according to reports from many industrial centers, is more prevalent than before the War. This increase in light sensitivity may be traced directly to the fact that so many men and women in war industries are working on highly reflective metals and plastics under high illumination, often concentrating at the near point for extended periods of time.

Relief is provided in many cases of light sensitivity when the ametropic correction is made in neutrally absorptive Soft-Lite Lenses. Cases have also been cited in which patients whose eyes are emmetropic report relief from strain and fatigue upon the prescription of plano Soft-Lite Lenses.

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